Chapter 9: Cellular Reproduction
9.1 Cellular Growth
I. Cell size limitation
A. The key factor that limits the size of the cell is the ratio of its surface area to its volume
1. Ratio of surface area to volume is 6:1 for a cube
2. As a cell grows its volume increases much more rapidly than the surface area
→ see figure 2, p. 494
B. Transport of substances
1. Small cell size maximizes the ability of diffusion and motor proteins to transport nutrients and waste products.
2. Cellular communications – the need for signaling proteins to move throughout the cell also limits cell size
a. If a cell becomes too large, cell communication can become extremely difficult
II. The cell cycle - the process by which cells reproduce by growing and developing
→ see Figure 11, p. 497 for description of the three stages of the cell cycle: interphase, mitosis, and cytokinesis

Jan 13-2:22 PM

A. Interphase - stage of the cell cycle where cell grows and DNA is replicated for division
1. 3 substages: $S_1 \rightarrow G \rightarrow S_2$
B. Mitosis - stage of the cell cycle during which cell's nucleus and nuclear material divide
1. Mitosis has four substages: prophase, metaphase, anaphase, telophase
C. Cytokinesis - the method by which a cell's cytoplasm divides; form two new cells
D. Chromosomes - structures that contain the genetic material for heredity
1. Chromatin - the relaxed (condensed) form of DNA in the cell's nucleus

Jan 14-3:01 PM

Bellringer

$1.36\ g\ H_2O \times \frac{1\ mol}{18\ g} = ?\ mol\ H_2O$

$1.64\ g\ MgSO_4 \times \frac{1\ mol}{120.37\ g} = ?\ mol\ MgSO_4$

24.3
32.07
+64
120.37

% mass of H_2O

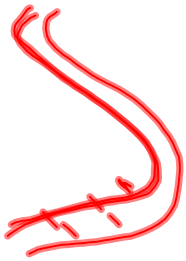
Feb 19-2:04 PM

Bellringer

→ What is the central dogma of Biology?

→ What is a spliceosome?

RNA processing



→ What are introns? exons?

methylation

CH_3

→ What two mechanisms that regulate protein synthesis (in eukaryotes)?

Mar 4-11:45 AM

9.1 Review

Grade: 10th

Subject: Biology

Date:

Jan 14-3:24 PM

1 Cells decrease in surface area to volume ratio as the cell size increases

True

False

Jan 15-9:48 AM

2 What aspect of cell function involves moving substances and signals among organelles?

A apoptosis
B cellular communication
C mutation
D cytokinetic signals

Jan 15-9:49 AM

3 The method by which a cell's cytoplasm divides is called _____.

A DNA replication
B interphase
C mitosis
D cytokinesis

Jan 15-9:50 AM

4 Which of these is not an example of how substances move within cells?

A cytoskeleton network
B cell cycle
C motor proteins
D diffusion

Jan 15-9:52 AM

5 Why would diffusion be more inefficient in a large cell?

A it relies on motor proteins
B it relies on random movement of particles
C it relies on DNA mutations
D it relies on checkpoints in cell cycle

f

Jan 15-9:54 AM

9.2 Mitosis and Cytokinesis

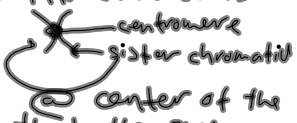
→ Main idea: Eukaryotic cells reproduce by mitosis, the process of nuclear division and cytokinesis, the process of cytoplasm division

I. Mitosis: a key activity of Mitosis is the accurate separation of the cell's replicated DNA into two identical daughter cells

II Stages of Mitosis (See Figure 9, p. 505)

(1) A. Prophase - 1st and longest stage of Mitosis

1. Chromatin condenses into chromosomes that form an X



2. Centromere - structure chromosome; ensures that the DNA becomes part of daughter cells

3. Nucleolus disappears; nuclear membrane disintegrates

4. Spindle apparatus forms between poles (microtubule structures)
   a. centrioles, microtubule structures, move to ends, or poles of the cell

Jan 15-4:08 PM

(2) B. Metaphase

1. Chromosomes attach to spindle apparatus and align along the cell equator (middle of cell)

(3) C. Anaphase - chromatids are pulled apart

1. Microtubules shorten, moving chromosomes to opposite poles

(4) D. Telophase - chromosomes arrive at the poles of the cell and to begin to relax and decondense

1. Two new nuclear membranes begin to form and the nuclei reappear; nucleolus reappears
2. Spindle apparatus disassembles

E. Cytokinesis begins after telophase; cytoplasm dividing along the furrow resulting in two identical daughter cells

F. In plant cells, a cell plate forms between the two daughter cell's nuclei during cytokinesis

Jan 16-2:42 PM

Bellringer

Calculate the surface area and volume for the following cells:

		SA	V
cell 1:	0.0002 cm	2.4×10^{-7}	8×10^{-12}
cell 2:	0.01 cm	6×10^{-4}	1×10^{-6}
cell 3:	2.5 cm	37.5	15.625
cell 4:	30 cm	13,500,000	3,375,000,000
cell 5:	15 m		

30,000 → 600 → 2.4 → .004

* What is the relationship between cell surface area and volume as cell size changes?

Mar 6-2:08 PM

Bellringer

→ Balance the following equation:

$2\ Na_{(s)} + 2\ H_2O_{(l)} \rightarrow 2\ NaOH_{(aq)} + \_\ H_{2\ (g)}$

then demonstrate that the mass of the reactants is equal to the mass of the products.

→ Determine all of the possible mole ratios for:

$4\ Al_{(s)} + 3\ O_{2\ (g)} \rightarrow 2\ Al_2O_{3\ (s)}$

→ Balance and determine the possible mole ratios for:

$2\ ZnO_{(s)} + 4\ HCl_{(aq)} \rightarrow 2\ ZnCl_{2\ (aq)} + 2\ H_2O_{(l)}$

$ZnO + 2HCl \rightarrow ZnCl_2 + H_2$

$\frac{1\ mol\ ZnO}{2\ mol\ HCl}$, $\frac{2\ mol\ HCl}{1\ mol\ ZnO}$

Mar 10-7:56 AM

Bellringer

→ Why are cells so small?

$\frac{SA}{V}$ 

→ What are the "Stages" of the cell cycle?

Interphase, Mitosis, Cytokinesis
G_1, S, G_2 PMAT

→ What is apoptosis? Why is this important?

programed cell death

Mar 13-2:03 PM

9.2 Review

Grade: 10th

Subject: Biology

Date:

Jan 15-4:08 PM

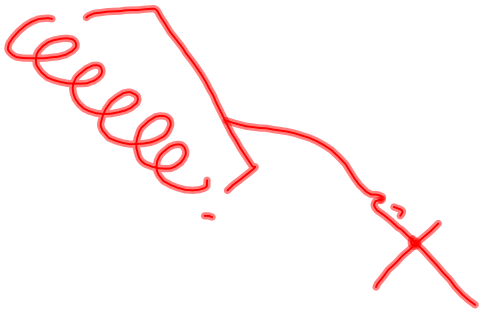
1 The phase of cell division in which chromatin condenses into chromosomes is _____.

A telophase
B anaphase
C prophase
D apoptosis

Jan 15-4:19 PM

2 The _____ contains spindle fibers, aster fibers, and centrioles.

A spindle apparatus
B centromeres
C chromosome
D nuclear envelope



Jan 15-4:20 PM

3 During metaphase, what are the structures that line up on the cell equator?

A cyclins
B single chromatids
C chromosomes
D kinases

Jan 15-4:21 PM

4 During _____ (a phase of mitosis) the sister chromatids that aligned on the cell equator during metaphase begin to pull apart.

anaphase

Jan 15-4:23 PM

5 Which of these events do not occur during telophase?

A chromosomes align at the cellular poles
B cytoplasm splits into two
C chromosomes relax
D spindle apparatus disassembles

cytokinesis

Jan 15-4:27 PM

6 The cell cycle consists of three distinct stages: interphase, mitosis, and cytokinesis. Mitosis is the longest stage of the cell cycle.

True
False

Jan 15-4:28 PM

9.3 Cell Cycle Regulation

- Main idea: the normal cell cycle is regulated by cyclin proteins

I. Normal Cell Cycle

A. the timing and rate of cell division are important to health of an organism; proteins and enzymes controls cell cycle rate

B. The role of cyclins (Figure 6.1 p. 512)

1. Cyclins - proteins that bind to cyclin-dependent kinases (CDKs) during interphase and Mitosis
   a. starts signaling to begin cell reproduction

C. Quality control checkpoints

1. Cell cycle has built in checkpoints to prevent abnormal cells from being produced

Jan 15-9:46 AM

II Abnormal Cell Cycle: Cancer

A. Cancer - the uncontrolled growth and division of cells

1. Cancer results from failure in regulation of the cell cycle

B. Causes of Cancer

Jan 18-1:13 PM

9.3 Review

Grade: 10th

Subject: Biology

Date:

Jan 19-6:24 PM

1 What can result from improper regulation in the cell cycle?

A cancer
B apoptosis
C control checkpoints
D mitosis without a prophase

Jan 19-6:27 PM

2 Substances known to cause cancer are called _____.

A kinases
B carcinogens
C stem cells
D aster fibers

Jan 19-6:28 PM

3 After fertilization, a mass of unspecialized cells called _____ form.

A nerve cells
B embryonic stem cells
C cardiac cells
D apoptosis cells

Jan 19-6:29 PM

4 What would happen if cyclins did not function properly in the cell cycle?

A cell cycle would not start
B rapid cell division would occur
C cyclin-dependent kinases would start cell cycle
D rapid mutation would occur

Jan 19-6:30 PM

5 A process called _____ is essentially programmed cell death.

apoptosis

Jan 19-6:38 PM

Bellringer

→ What is the role of the Cyclin – CDK enzyme complex?

→ How does cancer occur?

→ What are the cell "checkpoints"? Where do they occur?

Mar 17-2:05 PM

sciencedaily.com

Mar 17-2:16 PM

Mitosis & Cell Reproduction Review

Grade: 10th

Subject: Biology

Date:

Jan 29-4:48 PM

1 The period in which the cell is not dividing during the cell cycle is known as _____.

Jan 29-4:49 PM

2 The process of nuclear division or cell division that results in two identical daughter cells is known as _____.

Jan 29-4:50 PM

3 The _____ _____ (2 words) is the sequence of events in the life of a eukaryotic cell.

Jan 29-4:50 PM

4 Which is a reason why cells remain small?

A large cells have difficulty diffusing nutrients rapidly enough
B As cells grow, their ratio of surface area to volume increases
C transportation of wastes becomes a problem for large cells
D all of the above

Jan 29-4:52 PM

5 What is the ratio of surface area to volume in a cell?

A 2:1
B 3:1
C 4:1
D 6:1

Jan 29-4:53 PM

6 Of the surface area-to-volume ratio, what does the surface area represent in a cell?

A nucleus
B plasma membrane
C mitochondria
D cytoplasm

Jan 29-4:54 PM

7 Which describes the activities of a cell that include cellular growth and cell division?

A chromatin
B cytoplasm
C mitosis
D cell cycle

Jan 29-4:54 PM

8 Starting with one cell that underwent six divisions, how many cells would result?

A 13
B 32
C 48
D 64

Jan 29-4:56 PM

9 As the cell's volume increases, what happens to the proportional amount of surface area?

A increases
B decreases
C stays the same
D reaches its limit

Jan 29-4:56 PM

10 What stage occurs when DNA molecules are being replicated?

A prophase
B G1 stage
C S stage
D G2 stage

Jan 29-5:00 PM

11 The stage of the cell cycle when the cytoplasm divides resulting in two identical daughter cells is _____.

Jan 29-5:00 PM

12 The cancer drug vinblastine interferes with synthesis of microtubules. In mitosis, this would interfere with what?

A spindle formation
B DNA replication
C carbohydrate synthesis
D disappearance of the nuclear envelope

Jan 29-5:02 PM

13 Stem cells undergo uncontrolled, unrestrained growth and division because their genes have been changed.

True
False

Jan 29-5:03 PM

14 Cancer is a cell response to DNA damage that results in cell death.

True
False

Jan 29-5:04 PM

15 _____ are substances that cause cancer.

Jan 29-5:04 PM

16 What is the role of cyclins in a cell?

A to control the movement of microtubules
B to signal for the cell to divide
C to stimulate the breakdown of nuclear membrane
D to cause the nucleolus to disappear

Jan 29-5:05 PM

17 What substances form the cyclin-cyclin dependent kinase combinations that control the stages in the cell cycle?

A fats and proteins
B carbohydrates
C proteins and enzymes
D fats and enzymes

Jan 29-5:06 PM

18 Which is a characteristic of cancer cells?

A controlled cell division
B contain multiple genetic changes
C cytokinesis stage is skipped
D cell cyclins function normally

Jan 29-5:08 PM

19 Which describes apoptosis?

A occurs in all cells
B is a programmed cell death
C disrupts the normal development of an organism
D is a response to hormones

Jan 29-5:09 PM

20 Why have some stem cell researchers experienced roadblocks in their studies?

A stem cells cannot be found
B there are ethical concerns about obtaining stem cells
C there are no known uses for stem cells
D stem cells do not become specialized cells

Jan 29-5:10 PM

21 MIXED REVIEW: What type of heterotroph is a mouse?

A carnivore
B detritivore
C herbivore
D omnivore

Jan 29-5:11 PM

22 MIXED REVIEW: Which carbon-containing compound is the product of glycolysis?

A acetyl CoA
B glucose
C lactic acid
D pyruvate

Jan 29-5:12 PM